

Mafikeng region

A Krug, R C Pattinson, D J Power

Objective. To describe causes of under-5 deaths occurring in the health care system in Mafikeng region and modifiable factors related to these deaths.

Design. A prospective descriptive study.

Setting. The four public sector hospitals in Mafikeng health region in North West province (Gelukspan, Zeerust-Lehurutshe, Thusong, and Mafikeng Provincial Hospital).

Methods. This study of under-5 deaths used and piloted the Under-5 health care Problem Identification Programme.

Study period. 1 November 2000 - 31 October 2001.

Results. Two hundred and thirty-nine under-5 deaths occurred in the health system. The case fatality rate for the total of 4 226 under-5 admissions was 5.7%. Seventy-four per cent of the under-5 deaths occurred during the first year of life; 31% during the first 24 hours in hospital. The main causes of death

were lower respiratory tract infections (31.4%), AIDS (21.3%) and sepsis (13.4%). When adding all causes of death and contributing conditions, 61.9% were AIDS- or HIV-related. Eighty-three per cent of cases had administrative modifiable factors; 67% had modifiable factors at primary care level, 47% during admission/emergency care in hospital, and 55% during routine care.

Conclusions. Priority problems identified in this study were case management of lower respiratory tract infections, failure to thrive, and insufficient documentation of patient care. As most under-5 deaths in this study were HIV/AIDS-related, it is an urgent necessity to expand effective programmes to prevent mother-to-child transmission and HIV infection in adults and to advocate comprehensive treatment programmes for HIV/AIDS.

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North West Department of Health, Central Region, Mafikeng

A Krug, FCPaed (SA), MMed (Paed)

Medical Research Council Maternal and Infant Health Care Strategies Research Unit, Kalafong Hospital and University of Pretoria

R C Pattinson, MD, FCOG (SA), MRCOG

Department of Paediatrics and Child Health, University of Cape Town

D J Power, MD, MRCP, DCM

Mortality audits can be used to identify where and why health systems fail. However, in paediatric care they are mainly used in academic hospitals, where postmortems and histology services are available. The findings of these mortality audits may not be representative of the majority of paediatric deaths. Peripheral hospitals in developing countries, where most under-5 deaths take place, lack tools to conduct audits

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systematically. The concepts of clinical audit, the methods and processes in the development of a paediatric mortality audit system and an evaluation of the audit meetings have been described previously.¹ The audit tools are described in detail elsewhere.²

The aim of this prospective descriptive study was to pilot the Under-5 health care Problem Identification Programme (U5PIP), a mortality audit for under-5 deaths, and to describe causes of under-5 deaths occurring in peripheral hospitals in Mafikeng region and modifiable factors related to these deaths.

Methods

The four public sector hospitals in Mafikeng region in North West province (Gelukspan, Zeerust-Lehurutshe, Thusong, and Mafikeng Provincial Hospital), where one of the authors works as regional paediatrician (AK), all participated in this study. The region has 95 primary health care (PHC) facilities. The study population consisted of all under-5 inpatients in the four hospitals during the study period from 1 November 2000 to 31 October 2001.

The method used to identify causes of death and modifiable factors in a mortality audit is the U5PIP.¹ The classification of deaths is based on the *International Classification of Diseases 10* (ICD-10) and the standard South African treatment guidelines for paediatric hospital care (www.sadap.org.za/edl/paed). One main cause of death, two other causes of death, and up to two other contributing conditions can be entered.^{1,2} Modifiable factors were defined as events, actions or omissions contributing to the death or contributing to substandard care in a child who died, and which can be modified by means of locally achievable interventions.^{1,2} Consensus on causes of death, contributing conditions and modifiable factors was reached during the audit meetings, using the patient records and the road-to-health card. The road-to-health-card is a patient-retained record of the child's weights, immunisations and health care given at primary level.

Fig. 1 summarises the data collection and audit process of the pilot study, conducted in Mafikeng region during the study period.

Permission to conduct the study was granted by the Ethics Committee of the University of Pretoria, by the North West Department of Health, and by the superintendents of the study hospitals. The only other procedures performed were the voluntary interviews with the mothers/primary caregivers. Informed consent and confidentiality were adhered to.

Results

Two hundred and thirty-nine under-5 deaths occurred in the study hospitals, viz. Mafikeng Provincial, Thusong, Gelukspan and Lehurutshe-Zeerust during the study period (Fig. 1).

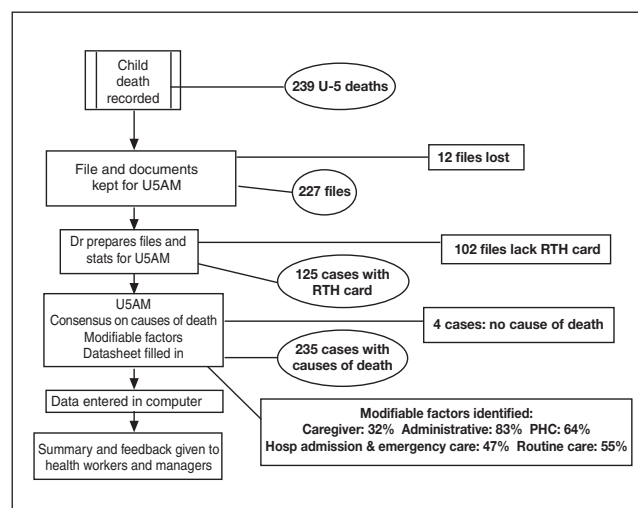


Fig. 1. Audit of under-5 deaths in Mafikeng region — data collection and audit process (U5AM: under-5 deaths audit meeting).

Twelve files were lost, the road-to-health card was missing in 102 cases, and in 4 cases causes of death could not be ascertained. Modifiable factors related to the caregiver were identified in 32% of cases. Eighty-three per cent involved administrative modifiable factors. Medical personnel-related modifiable factors were identified in 64% of cases at PHC level, in 47% during hospital admission and emergency care, and in 55% during routine care.

Seventy-four per cent of the deaths occurred in children aged 1 - 11 months; 15% were between 12 and 24 months old. Five, four and two per cent of the deaths occurred in the third, fourth and fifth years of life respectively. Thirty-one per cent of the deaths occurred during the first 24 hours in hospital. Sixty-nine per cent of the children who died were below the third percentile of weight for age, and 26% had normal weights. In 5% of cases the weights were not known.

The main causes of death are given in Table I. Of the 227 cases with patient records, 129 cases (56.8%) had 2 or more causes of death. Adding up all causes of death identified, the most common ones were lower respiratory tract infections (LRTIs) (44.4%), AIDS (21.3%), sepsis (21.3%) and severe malnutrition (16.3%).

Twenty-nine per cent of the children who died had symptomatic HIV disease, but could not be tested; 11% had symptomatic HIV disease with positive HIV tests. In the case of children with symptomatic HIV disease, HIV was classified as a 'contributing health problem'. In 56% of these children the main causes of death were LRTIs. Adding the categories of AIDS and symptomatic HIV disease, 148 deaths (61.9%) were AIDS or HIV-related.

During the study period a total of 4 226 children under 5 years were admitted and 239 under-5 deaths occurred; the case-fatality rate (CFR) was 5.7%. Seventy-nine of 1 233

**Table I. Probable main causes of under-5 deaths in hospitals in Mafikeng region**

	No. of cases	% of total
Lower respiratory tract infection (LRTI)	75	31.4
AIDS	51	21.3
Sepsis/possible serious bacterial infection	32	13.4
Severe malnutrition (marasmus, kwashiorkor)	15	6.3
Bacterial meningitis	13	5.4
Acute gastroenteritis (GE)	9	3.8
TB (pulmonary/extrapulmonary)	8	3.3
CCF/pulmonary oedema	6	2.5
Trauma (burns/motor vehicle accident)	6	2.5
Other CNS infection	5	2.1
Inhalation of gastric contents/foreign body	3	1.3
Liver disease	3	1.3
Chronic diarrhoea	2	0.8
Status epilepticus	2	0.8
Congenital heart disease, myocarditis	2	0.8
Other	3	1.3
No information	4	1.7
Total	239	100

TB = tuberculosis; CCF = congestive cardiac failure; CNS = central nervous system.

children admitted with LRTIs died (CFR 6.4%). The figure for gastroenteritis admissions was 10 of 717 children (CFR 1.4%).

In 32.4 % of cases modifiable factors were family-related. The main problems identified were delay in seeking care (15.2%) and infrequent clinic attendance (11%). Summaries of other modifiable factors identified are given in Tables II and III. Eighty-three per cent of cases had administrative modifiable factors (Table II). The main problems identified were road-to-health card missing (47.7%) and insufficient notes (16.3%).

Table III demonstrates weaknesses in the performance of medical personnel (doctors and nurses) at different levels of care. Modifiable factors are grouped in the main categories of case assessment, monitoring and case management. Details and subcategories of the modifiable factors are published elsewhere.² The main problems identified at PHC level were related to weight monitoring and respiratory infections. At hospital level, deficiencies were related to insufficient case assessment, oxygen monitoring, prescribing of antibiotics and intravenous fluids.

Discussion

The main limitation when using this U5PIP to describe causes of death and modifiable factors was poor documentation of patient care at all levels. This makes audits ineffective and may lead to underestimation of deficiencies and modifiable factors in health care. As we continue to use the audit as an

Table II. Modifiable factors — administrative problems in under-5 deaths as identified by the U5PIP in hospitals in Mafikeng region

	No. of cases*	% (N = 239 cases)
Road-to-health card missing	114	47.7
Road-to-health card not used appropriately	18	7.5
Transport problems	23	9.6
Lack of accessibility/lack of health care facility	30	12.6
Lack of personnel/lack of appropriately trained personnel	20	8.4
Communication problems: staff - staff/staff-caregiver	45	18.8
Lack of drugs/IV solutions/oxygen/blood products	16	6.7
Lack of equipment/equipment not functioning	31	13
Notes insufficient	39	16.3
Other	18	7.5
No administrative modifiable factor	41	17.2

*A case can have more than one modifiable factor.
IV = intravenous.

assessment tool, it will show if the feedback from audit meetings is sufficient to improve record keeping or if other interventions are needed.

Seventy-four per cent of under-5 deaths occurred during the first year of life. Sixty-nine per cent of the children who died were below the third percentile of weight for age. It is well known that younger children and underweight infants are at higher risk of dying.^{3,4} The prevalence of underweight and severe malnutrition is high among HIV-positive children.^{5,6}

In the present study 31.4% of cases died of LRTI, whereas only 4.6% had acute or chronic diarrhoea. A decrease in diarrhoea-related deaths has also been reported in other regions. LRTIs are now a leading cause of death in children in developing countries worldwide.^{3,4,7,8}

In this pilot study it is estimated that 61.9% of under-5 deaths were HIV-related, which shows the tremendous burden of HIV in the South African population. The World Health Organisation (WHO) clinical classification for AIDS in children has a high specificity but a low sensitivity.^{5,6,9} We may therefore have underestimated the prevalence of AIDS and symptomatic HIV infection in our study population. Clearly, this catastrophe needs urgent and comprehensive strategies to prevent HIV infection in young adults and mother-to-child transmission. It also needs effective and compassionate treatment and care of those infected.

The overall CFR for the study hospitals during the study period was 5.7%; the CFR for LRTIs was 6.4% and for gastroenteritis admissions 1.4%. In comparison, Chris Hani Baragwanath Hospital in Johannesburg had an overall paediatric CFR of 3.9% in 1992 and 9.1% in 2000. The increase

**Table III. Modifiable factors — medical personnel-related problems in under-5 deaths identified by the U5PIP in hospitals in Mafikeng region**

	No. of cases*	%
Primary health care level (total number of assessable cases = 125)		
Insufficient case assessment	35	28
Insufficient case monitoring	25	20
Insufficient case management	40	32
Delay in referring acute problem	34	27
Delay in referring chronic problem	37	30
Other modifiable factor at PHC level	9	7
No modifiable factor identified at PHC level	45	36
Hospital admission and emergency care (total number of assessable cases = 199)		
Insufficient case assessment	48	24
Insufficient case monitoring	50	25
Insufficient case management	38	19
No modifiable factor identified at hospital admission and emergency care	106	53
Hospital routine care and referral (total number of assessable cases = 190)		
Insufficient case assessment	28	15
Insufficient case monitoring	23	12
Insufficient case management	39	21
Delay in calling for senior opinion/referring	15	8
Inadequate IV fluids (prescription, recording or administered)	31	16
Inadequate feeding (prescription, recording or administered)	18	10
Other modifiable factor in hospital routine care/referral	7	4
No modifiable factor identified in routine care/referral	85	45

* A case can have more than one modifiable factor.

PHC = primary health care; IV = intravenous.

was due to HIV-related deaths (J M Pettifor — personal communication, Department of Paediatrics, Chris Hani Baragwanath Hospital, 2001). Baragwanath is a referral hospital for more complicated, severe cases; therefore a higher CFR can be expected.

In most cases care seeking was prompt and co-operation between caregivers and health services was satisfactory, which is similar to the findings of other studies.^{10,11}

Eighty-three per cent of cases had administrative modifiable factors (Table II). The main problems were road-to-health card missing (47.7%) and insufficient notes (16.3%). Obviously, the first step in implementing an audit is to improve documentation of care and data collection. In 9.6% of deaths transport problems were identified, and in 8.4% shortage of appropriately trained personnel. This may well be an underestimation, as many records were incomplete.

Lack of functioning equipment contributed to substandard care in 31 cases; in 28 cases a pulse oximeter was lacking. To have actual cases where lack of basic equipment contributed to a death helped to motivate for three new pulse oximeters, to get two pulse oximeters repaired, and to replace eight probes in the different hospitals during the study period. In one district hospital we achieved better placement and access to the pulse oximeters after hours.

In two hospitals junior doctors doing their community

service frequently complained that they were left alone with critically ill patients. Cases discussed in the audit meetings helped to make health managers more aware of this problem. This finally led to the appointment of four senior doctors. Clearly, strategies are needed to retain senior health workers in rural areas.

At PHC level the medical personnel-related problems that were identified motivated us to start the WHO Integrated Management of Childhood Illness (IMCI) programme in the region, a training and quality improvement programme for paediatric primary care.¹² The audit demonstrated to health managers that key points of the IMCI have not yet been implemented, e.g. appropriate case management for failure to thrive and for acute respiratory infections.

At hospital level weaknesses were found in paediatric case assessment and case management. In-service training was conducted for doctors and nurses on pneumonia and paediatric TB case management, especially oxygen therapy, monitoring of respiratory distress, antibiotics, feeding and intravenous fluid management. New charts for fluid intake were tested by nurses and doctors and were introduced with lectures on fluid management in dehydration and shock.

Discussing terminally ill children in audit meetings frequently clarified decisions and practical aspects of palliative care. The under-5 audit does not strive for maximal care, but



for optimal, locally achievable care for the child and family in a holistic manner. This may lead to discharge of a terminally ill child, in accordance with the wishes of the family. Effective pain treatment, relevant oral treatment, e.g. for candidiasis, and appropriate feeding are part of achievable care.

Referral criteria and communication with regional or tertiary hospitals were discussed during several audit meetings.

In summary, the main problem areas identified in this audit pilot were lack of patient records to evaluate care, the high incidence and deficient case management of LRTIs and failure to thrive, and inadequate management of intravenous fluids.

The following strengths of the audit system were noted: (i) actual cases, where the implementation of an achievable improvement (e.g. the repair of a pulse oximeter) could make a difference, were strong motivators when discussing problems with health managers; and (ii) it was motivating for health workers to change practices when inadequate patient management had been identified as contributing to the death of a child.¹³

Conclusions

The U5PIP can be used as a mortality audit system in peripheral hospitals in South Africa to identify causes of death and modifiable factors related to these deaths. We recommend that the system be field tested by other paediatric teams including peripheral hospitals, to gain broader experience of the main causes of under-5 inpatient deaths and modifiable factors related to these deaths. This may indicate priority areas, where interventions can decrease preventable deaths.

As 61.9% of under-5 deaths in this study were HIV/AIDS-related, there is an urgent need to expand effective programmes to prevent mother-to-child transmission and HIV infection in adults and to advocate comprehensive treatment programmes, especially for pregnant women, young mothers and their children.

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References

1. Krug A, Pattinson RC, Power D. Saving children — an audit system to assess under-5 health care. *S Afr Med J* 2004; **94**: 198-202 (this issue).
2. Krug, A. Developing an audit system for under-5 deaths and under-5 healthcare in peripheral hospitals and piloting it in Mafikeng region, South Africa. Master of Public Health thesis, University of Pretoria, School of Health Systems and Public Health, 2002.
3. World Health Organisation. *Management of the Child With a Serious Infection or Severe Malnutrition*. WHO/FCH/00.1. Geneva: WHO, 2000.
4. Eichenwald HF, Mulholland K, Margolis P, et al. Etiology and clinical signs of serious infections in young infants in developing countries: a WHO collaborative study. *Pediatr Infect Dis J* 1999; **18**: S1-S69.
5. Colebunders RI, Greenberg A, Nguyen-Dinh P, et al. Evaluation of a clinical case definition of AIDS in African children. *AIDS* 1987; **1**: 151-153.
6. Lepage P, Perre P van de, Dabis F, et al. Evaluation and simplification of the World Health Organization clinical case definition for paediatric AIDS. *AIDS* 1989; **3**: 221-225.
7. Reyes H, Perez-Cuevas R, Salmeron J, Tome P, Guiscafre H, Gutierrez G. Infant mortality due to acute respiratory infections: the influence of primary care processes. *Health Policy Planning* 1997; **12**: 214-223.
8. Duke T, Michael A, Mgone J, Frank D, Wal T, Sehuko R. Etiology of child mortality in Goroka, Papua New Guinea: a prospective two-year study. *Bull World Health Organ* 2002; **80**: 16-25.
9. Centers for Disease Control and Prevention. 1994 revised classification system for human immunodeficiency virus infection in children less than 13 years of age. *Morb Mortal Wkly Rep* 1994; **43**: 1-12.
10. De Zoysa I, Bhandari N. Careseeking for illness in young infants in an urban slum of India. *Soc Sci Med* 1998; **47**: 2101-2111.
11. Sodemann M, Jakobsen MS. High mortality despite good care-seeking behaviour: a community study of under-5 deaths in Guinea-Bissau. *Bull World Health Organ* 1997; **75**: 205-212.
12. World Health Organisation and UNICEF. *Integrated Management of Childhood Illness*. Geneva: WHO, 1997. South African generic adaptations by the South African National Department of Health. Pretoria: WHO, 1999.
13. Sullivan MJ, Guyatt GH. Simulated cardiac arrests for monitoring quality of in-hospital resuscitation. *Lancet* 1986; **328**: 618-620.

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